

WHAT IS CLAIMED IS:

1. A pattern observation apparatus comprising:  
a table generating section for generating a table  
in which a scan order is associated with scan  
5 positions;

a charged particle beam scanning mechanism for  
scanning, according to the table, a charged particle  
beam over a sample on which a pattern is formed;

10 a detection mechanism for detecting secondary  
electrons produced from the sample by the scanning of  
the charged particle beam, and outputting secondary  
electron detection signals;

15 an image information generating section for  
rearranging the secondary electron detection signals  
in association with the scan positions on the basis  
of the table, thereby generating image information of  
a surface of the sample; and

20 a pattern position determination section for  
determining a pattern position on the basis of the  
image information.

2. A pattern observation apparatus according to  
claim 1, wherein said table generating section  
generates the table by selecting the scan positions at  
random according to the scan order.

25 3. A pattern observation apparatus according to  
claim 1, wherein said table has a first scan procedure  
and a second scan procedure, and

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a locus of the charged particle beam scanned by the second scan procedure is substantially equal to a locus of the charged particle beam scanned by the first scan procedure, and both loci are reverse to each other.

4. A pattern observation apparatus according to claim 1, further comprising a charged particle beam exposure section for effecting an alignment exposure of a desired pattern, on the basis of the pattern position determined by the pattern position determination section.

5. A pattern observation apparatus according to claim 1, wherein said sample has a first mark formed in a substrate and a second mark formed on a surface of the substrate, the first and second marks serving as a reference for alignment exposure, and

the pattern observation apparatus further comprises relative position measuring means for measuring a relative position of the first mark and the second mark.

6. A pattern observation apparatus for observing a pattern by radiating a charged particle beam on a sample in which the pattern is formed on a substrate and a first film is formed on the substrate including the pattern, the apparatus comprising:

a first beam radiation section for performing a first charged particle beam radiation on the sample

including the pattern, and charging a surface of the sample;

5 a second beam radiation section for scanning the charged particle beam over the pattern under conditions different from conditions for the first charged particle beam radiation; and

an observation section for observing the pattern by detecting secondary electrons from the surface of the sample.

10 7. A pattern observation apparatus according to claim 6, wherein said first and second beam radiation sections are composed of the same beam source, and the pattern observation apparatus further comprises:

15 a radiation condition setting section for setting radiation conditions which are different at least between the first radiation section and the second radiation section; and

20 a radiation condition switching section for switching, when the pattern is observed, the radiation conditions of the first radiation section to the radiation conditions of the second radiation section.

25 8. A pattern observation apparatus according to claim 6, wherein said first and second beam radiation sections are composed of different beam sources, and

a beam radiation area of the first radiation section is greater than a beam radiation area of the

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second radiation section.

9. A pattern observation apparatus according to claim 6, further comprising:

5 a pattern position detection section for detecting a pattern position on the basis of the pattern observed by the observation section; and

a charged particle beam exposure section for effecting an alignment exposure of a desired pattern on the basis of the pattern position.

10 10. A pattern observation apparatus according to claim 6, wherein said pattern is formed on the substrate as a reference for an alignment exposure, and a mark is formed on a surface of the substrate, and  
15 the pattern observation apparatus further comprises relative position measuring means for measuring a relative position of the pattern and the mark.

11. A pattern observation method comprising the steps of:

20 generating a table in which a scan order is associated with scan positions;

scanning a charged particle beam over a sample according to the table;

25 detecting secondary electrons produced from the sample by the scanning of the charged particle beam, and outputting secondary electron detection signals;

rearranging the secondary electron detection

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signals in association with the scan positions on the basis of the table, thereby generating image information of a surface of the sample; and

5 determining a pattern position on the basis of the image information.

12. A pattern observation method according to claim 11, wherein said table is generated by selecting the scan positions at random according to the scan order, whereby the charged particle beam is made to  
10 scan the sample at random.

13. A pattern observation method according to claim 11, wherein said table has a first scan procedure and a second scan procedure, and

15 a locus of the charged particle beam scanned by the second scan procedure is substantially equal to a locus of the charged particle beam scanned by the first scan procedure, and both loci are reverse to each other.

20 14. A pattern observation method according to claim 11, further comprising a step of effecting an alignment exposure of a desired pattern on the basis of the pattern position determined by the pattern position determination section.

25 15. A pattern observation method according to claim 11, wherein said sample has a first mark formed in a substrate and a second mark formed on a surface of the substrate, the first and second marks serving as

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a reference for alignment exposure, and

the pattern observation method further comprises a step of measuring a relative position of the first mark and the second mark.

5 ~~16.~~ A pattern observation method for observing a pattern by radiating a charged particle beam on a sample in which the pattern is formed on a substrate and a first film is formed on the substrate including the pattern, the method comprising:

10 a first step of performing a first charged particle beam radiation on the sample including the pattern, and charging a surface of the sample;

15 a second step of scanning the charged particle beam over the pattern under conditions different from conditions for the first charged particle beam radiation; and

a third step of observing the pattern by detecting secondary electrons from the surface of the sample.

20 17. A pattern observation method according to claim 16, further comprising:

a step of detecting a pattern position on the basis of the observed pattern; and

a step of effecting an alignment exposure of a desired pattern on the basis of the pattern position.

25 18. A pattern observation method according to claim 16, wherein said pattern is formed on the substrate as a reference for an alignment exposure, and

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a mark is formed on a surface of the substrate, and the pattern observation method further comprises a fourth step of measuring a relative position of the pattern and the mark.

5           19. A charged particle beam exposure method  
according to claim 16, wherein beam radiation  
conditions in the first and second steps are varied  
such that the amount of charged particles radiated on  
the surface of the sample by the scanning of the  
0 charged particle beam becomes less than the amount of  
charged particles radiated on the surface of the sample  
by the first beam radiation.

20. A charged particle beam exposure method  
according to claim 16, wherein beam radiation  
15 conditions in the first and second steps are varied  
such that the amount of charged particles radiated on  
the surface of the sample by the scanning of the  
charged particle beam becomes less than the amount of  
charged particles radiated on the surface of the sample  
20 by the first beam radiation, and

the beam radiation conditions varied in the first and second steps are at least one of an acceleration voltage, a beam size, a beam current density, a beam scan speed and a beam scan position.

25           21. A charged particle beam exposure method  
according to claim 16, wherein following the first beam  
radiation, secondary electrons from the charged surface

of the sample are detected to approximately detect the position of the pattern, and the charged particle beam is scanned on the basis of the detected position.

22. A charged particle beam exposure method  
5 according to claim 16, wherein following the first beam radiation, secondary electrons from the charged surface of the sample are detected to approximately detect the position of the pattern, and the charged particle beam is scanned on the basis of the detected position, and

10 the charged particle beam is scanned, with at least one of an acceleration voltage, a beam size, a beam current density, a beam scan speed, a beam scan position and a beam shape varied in accordance with the position on the sample.

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